

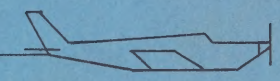
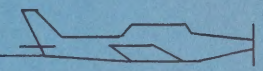
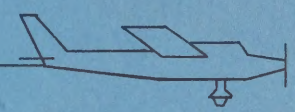
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# canadian general aviation



1967 - 1980










## PREFACE

The object of this booklet is to provide an initial report on the data collected in a questionnaire survey of Canadian aircraft owners during the summer and fall of 1968. By and large, the booklet merely presents statistical information, although some analytical input is implied in the way in which the data have been organized for presentation, and the final chapter contains a first attempt to forecast future levels of activity based on the data collected.

More work is being done on the data at the School of Community and Regional Planning of the University of British Columbia and within the Department of Transport; if results warrant such action, further publications will be forthcoming.

The work on the survey which has culminated in this report was carried out mainly by three people: Wayne McNeal of this Branch, who has just completed requirements for a Master's degree at U.B.C.; Ken Marks of the Aviation Statistics Centre of DBS; and Bert Saumur, formerly of the Transportation Policy and Research Branch but now working for Air Services of the Canadian Department of Transport.



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## CHAPTER 1

### Summary

#### I Aircraft Fleet

The number of aircraft registered in Canada in 1967 totalled 9,098. Within this total, only 8,231 had valid certificates of airworthiness. Of the active aircraft, 5,306 were privately registered, 2,725 were commercially registered, and 200 were registered to the state. All but 198 aircraft can be considered to be in the general aviation category.

#### II Aircraft Utilization

Civil aviation aircraft flew a total of 2,227,280 hours in 1967. Of this total, some 1,825,369 hours can be attributed to general aviation. Commercial non-scheduled aircraft flew 1,144,664 hours, private aircraft some 603,311 hours and state aircraft flew 77,394 hours.

#### III Average Annual Utilization

The average annual utilization of the active civil aviation fleet was 261 hours in 1967. Commercial non-scheduled air carriers averaged 551 hours per aircraft. Private aircraft hours were quite low, averaging only 113 hours. State aircraft average annual utilization was 386 hours.

#### IV Forecast

##### (a) Civil Aircraft Fleet -

The number of civil aircraft registrations is forecast to grow from 9,098 in 1967 to 17,447 by 1980. All but approximately 270 of this total will be general aviation aircraft.

##### (b) Civil Aircraft Utilization -

By 1980, total civil aviation in hours flown are forecast to reach 4,508,572. The estimated average rate of increase from 1967 is just under 6% per annum.





## CHAPTER 2

### Introduction

#### I Definition

There is no generally accepted definition for "General Aviation"; for the purposes of this booklet, it has been decided to use the term in the sense "all non-scheduled aircraft flights". These flights may be undertaken on a private basis, on a commercial basis, or for government purposes and usually a relatively small aircraft is involved. In contrast, "Scheduled Aviation" is nearly always carried out under commercial terms and with large aircraft.

This booklet deals with "General Aviation" in the sense that effort has been concentrated on private and non-scheduled commercial flying. However, in some cases it proved difficult to draw a clear distinction between "General Aviation" and "Scheduled Aviation", and it was decided that the best thing to do was to show total figures, while clearly indicating that the data include "Scheduled Aviation"; in reading these sections, it might be helpful to keep in mind that, in 1967, aircraft belonging to scheduled air carriers represented roughly 2% of the total fleet and 20% of total hours flown.

#### II Importance of General Aviation

The growth of general aviation activity and the increasing use and acceptance of lighter general aviation aircraft by individuals, businesses and non-scheduled air carriers has been one of the outstanding aviation developments in recent years. There are over 8,000 active general aviation aircraft in Canada, and a rough estimate of the total value to the economy flowing from the operation of these aircraft would be \$95 million, including \$75 million for commercial non-scheduled flights and \$20 million for private flying. (The latter figure assumes that \$35 per hour, an average estimate of the cost to hire a small, single-engine aircraft with pilot, is a good figure to use to estimate the value which flows to individuals flying aircraft for private purposes.)

#### III Objective of Study

The over-all objective of this study was to overcome some of the gaps in our knowledge of Canadian general aviation in order to develop a forecast of general aviation activities through 1980 which should ultimately aid in improving the planning of facilities for this sector. The





forecasts should also permit an assessment of the demands which will be placed on the Department of Transport by future developments and changes in activity levels.

#### IV Background

Despite the growing importance of this segment of aviation, facts and figures pertaining to general aviation flying are not readily available. Little historical data concerning the number of aircraft and hours flown is available on a consistent and continuing basis. While some gross data have been available, the accuracy of the counts and the validity of the trends indicated thereby are subject to question and limit the value of the findings of many reports.

Other data gaps are apparent when one is concerned with such elements as: the socio-economic characteristics of aircraft owners and flight trainees (e.g., their age, occupation, income; the size and type of industry owning the aircraft); data on number of occupants, trip length and origin/destination of flights; characteristics, growth and significance of flying clubs; specifics with respect to motivations for business and personal use of particular aircraft types; aircraft turn over rates and sales of used aircraft; and data on attrition of older aircraft.

Statistical requirements of the Air Transport Committee provide information on non-scheduled air carrier activities. In contrast, information concerning private flying is fragmentary for the most part and often inconsistent. In 1962, the Economic Policy and Research Branch of the Department of Transport published "Canadian General Aviation 1961-1973". This study covered non-commercial aircraft activities during the 1961 calendar year. Although this study was extremely useful for Department of Transport aviation planning purposes, it is now considerably out-of-date.

#### V General Method of Approach

In order to obtain the necessary data, a comprehensive survey of general aviation aircraft owners was conducted during the summer of 1968. The survey basically up-dates the Canadian General Aviation survey of 1961 but also includes non-scheduled commercial air carrier activities. The survey was divided into two parts: private aviation and commercial aviation. Survey questionnaires were mailed to the registered owners of all private aircraft shown in the Canadian Civil Aircraft Register as of March 31, 1968. A separate questionnaire was mailed to all non-scheduled commercial air carriers operating aircraft pursuant to Air Transport Committee regulations.





Although every attempt was made to separate private aircraft from those operating commercially under the jurisdiction of the Air Transport Committee, it proved extremely difficult to determine precisely those aircraft which were not operated for commercial purposes. The frequency and rapidity of transfers by sale and lease between owners and complexities regarding legal ownerships were among the principal reasons for this difficulty.

## VI Methodology

General aviation data presented in this report has been derived from responses to questionnaires mailed to private owners and air carriers based in Canada during 1967. The data was collected and compiled by the Department of Transport with the cooperation and assistance of the Aviation Statistics Centre of the Dominion Bureau of Statistics.

### (a) Universe

#### 1) Private Aircraft Owners:

The universe for private aircraft from which this part of the survey was established was the file of private Canadian aircraft registered with the Department of Transport, Civil Aviation Branch. Included in the survey were those aircraft which had a valid certificate of airworthiness in effect for the period of December 31, 1966 to December 31, 1967. This file was restricted to exclude Gliders and Dirigibles. Included in the survey were aircraft registered as private, ultra light, private restricted and gyroplanes. Also, in order to restrict the survey to only the private sector of general aviation, the following aircraft were eliminated from the survey:

- (1) All commercial aircraft registered in the Canadian Civil Aircraft File.
- (2) State owned aircraft including Military.
- (3) Experimental aircraft.
- (4) Commercial (restricted) aircraft.

Within the framework of the private segment, survey questionnaires were sent to the entire universe which consist of 5,306 privately registered aircraft owners. This group consisted of 1,237 owners of business aircraft; 3,324 individual owners, 645 under joint ownership and 100 aircraft with other types of aircraft ownership.





ii) Commercial Aircraft:

The study of the commercial segment of the survey was based on the 400 reports submitted to the Air Transport Committee of the Canadian Transport Commission by Canadian air carriers.

Questionnaires were sent to all air carriers operating under licences 3, 4, and 7 issued by the Air Transport Committee of the Canadian Transport Commission to supplement information received on a continuing basis. Questionnaires were not sent to carriers authorized to operate only Class 1, 2, 8, and 9 services.

The Universe was categorized to show activity generated by unit toll operations, bulk and specialty flying. Specialty flying operations were further segregated to show activity reported under sub-sections of the Class 7 licence.

(b) Classification of Universe

The data received from private aircraft owners and the selected air carriers was divided into the following aircraft groups:

- Group 1 Single Engine - Light, up to 3,000 pounds
- Group 2 Single Engine - Medium, 3,001 to 5,000 pounds
- Group 3 Single Engine - Heavy, 5,001 pounds and above
- Group 4 Twin Engine - Light, up to 8,000 pounds
- Group 5 Twin Engine - Medium, 8,001 to 15,000 pounds
- Group 6 Twin Engine - Heavy, 15,001 pounds and above
- Group 7 Multi Engine Transport - All sizes
- Group 8 Gyroplanes
- Group 9 Helicopters - All types

(c) Questionnaire Design

The questionnaires were designed in consultation with the Canadian Owners and Pilots Association, the Air Transport Association of Canada and the Royal Canadian Flying Club Association. Units within the Department of Transport, Civil Aviation Branch, were also canvassed to determine the type of information required to meet their needs.

Questions were asked in the survey with a view to obtaining maximum useful information concerning such items as hours flown by type of flying, type of ownership, radio and other navigational equipment installed in aircraft, frequency of cross country and local flights, pilot qualifications, etc. as well as other pertinent information of value.





Two forms were designed and tested - one specifically oriented to the private sector of general aviation and the second basically related to the commercial aspect of general aviation. Allowances were made in the content of the survey forms to eliminate unnecessary questions for which information is already reported by commercial air carriers of hours flown by type of aircraft etc. The questionnaires were marked with the aircraft registration which identified the aircraft type and ownership. A covering letter was distributed with each questionnaire explaining who was doing the survey and why. Copies of the questionnaires and covering letters are included in the Appendices I to IV.

(d) Contact, Follow-up and Response

The questionnaire and covering letter from the Director, Transportation Policy and Research Branch of the Department of Transport were mailed to all members of the universe during the week of June 21, 1968. The survey was also publicized by aviation associations and trade periodicals.

Several weeks after the initial distribution an additional questionnaire and a follow-up letter were sent. (See Appendix IV). This procedure was considerably hampered because of a mail strike which occurred between July 18, 1968 and August 8, 1968. Although mail delivery returned to normal within several weeks after termination of the strike, the momentum and interest gained through publicity was lost. It is considered that the mail strike seriously affected the size of the response.

The questionnaire returns were classified by aircraft utilization in 1967 and aircraft group. Aircraft utilization was classified into:

- |                   |  |
|-------------------|--|
| Complete Year     | - Returns reported the aircraft was utilized for the full calendar year.                                 |
| Partial Year      | - Returns reported the aircraft was not utilized for the entire year.                                    |
| No Hours Reported | - Returns indicated that the aircraft was not used in 1967 or no indication of flying hours were stated. |

The following table indicates the number of total questionnaire returns received during the survey period from owners of privately-registered aircraft:





Table 1

Response to Aircraft Utilization Questionnaire

Private Aircraft

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>Complete Year</u>	<u>Partial Year</u>	<u>No Hours Reported</u>	<u>Non- Response</u>
Single Engine					
- Light	2,433	936	182	153	1,162
- Medium	2,263	892	159	132	1,080
- Heavy	125	47	6	7	65
Twin Engine					
- Light	285	146	19	23	97
- Medium	46	18	8	1	19
- Heavy	66	38	6	2	20
Multi Engine					
- Transport	5	-	-	-	5
Gyroplane	46	11	-	1	34
Helicopter	37	15	-	-	22
TOTAL	5,306	2,103	380	319	2,504

Source: 1967 Survey

Commercially registered aircraft air carrier responses were not broken down in the same detail as private aircraft since complete annual utilization was obtained from the Air Transport Committee files.

The total response to the survey was as follows:

Private Aircraft Owners - 52.8% response  
Commercial Aircraft Owners - 68.0% response

Despite factors which reduced the number of respondents to the survey, the above percentages are considered good for a mail questionnaire.

As far as the number of hours flown by private aircraft is concerned, the results of the sample survey were "blown-up" to give estimates of universe totals by considering each aircraft group separately. It was assumed that the sample





results were representative of the total for each aircraft group, and this assumption was further checked by drawing samples from the Certificate of Airworthiness register.

No attempt was made to "blow-up" the sample returns for any of the other data collected during the survey.





## CHAPTER 3

### General Aviation Activity

General aviation flying involves a multitude of uses for aircraft. Basically the various types of flying can be divided into three main groups:

- Commercial flying: represents the use of commercially registered aircraft for non-scheduled operations under the jurisdiction of the Air Transport Committee.
- Private flying: represents the use of privately-registered aircraft for a variety of personal and pleasure uses or as a transportation vehicle in the conduct of a business.
- State flying: represents the use of state registered aircraft used for a variety of civil operations conducted by federal and provincial governments.

#### I The Aircraft Fleet

As of March 31, 1968, there were 9,098 civil registered aircraft in Canada, an increase of 56 percent over the 1961 figure of 5,803. During the same period, the number of commercially registered aircraft increased 31 percent, from 1,987 to 2,614 aircraft. Privately registered aircraft rapidly increased from 3,635 to 6,277 aircraft; a 72 percent rise. State registered aircraft increased only 14 percent from 181 to 207 aircraft. The following table shows the increase in civil aviation registration from 1961 to 1967:

Table 2

#### Civil Aviation Aircraft Type of Registration

<u>Year</u>	<u>Private</u>	<u>Commercial</u> <sup>(1)</sup>	<u>State</u>	<u>Total</u>
1961	3,635	1,987	181	5,803
1962	3,987	1,972	183	6,143
1963	4,251	1,979	190	6,420
1964	4,652	2,018	194	6,864
1965	5,144	2,162	200	7,506
1966	5,721	2,344	200	8,265
1967	6,277	2,614	207	9,098

(1) Includes aircraft used by scheduled airlines.

Source: Canadian Civil Aircraft Register, aircraft registered as of March 31.





The Canadian Civil Aircraft Register was adjusted to exclude those aircraft which for a variety of reasons did not hold a valid certificate of airworthiness (C. of A.) at any time during the 1967 calendar year. This adjustment resulted in the following breakdown of civil aviation aircraft by type of registration and aircraft group.

Table 3

Adjusted Civil Aviation Aircraft Registration<sup>(1)</sup>

By Aircraft Group

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>Private</u>	<u>Commercial</u> <sup>(2)</sup>	<u>State</u>
Single Engine				
- Light	3,019	2,433	584	2
- Medium	3,183	2,263	916	4
- Heavy	525	125	311	89
Twin Engine				
- Light	498	285	199	14
- Medium	185	46	105	34
- Heavy	225	66	140	19
Multi Engine				
- Transport	139	5	128	6
Gyroplane	47	46	1	-
Helicopter	410	37	341	32
TOTAL	8,231	5,306	2,725	200

(1) Includes only those aircraft with a C. of A. in 1967 and excludes gliders and dirigibles.

(2) Includes approximately 198 aircraft which are reported to be operated by scheduled airlines.

Source: 1967 Survey

II Aircraft Utilization

Civil aviation aircraft flew a total of 2,227,280 hours in 1967. General aviation aircraft can be credited with some 1,825,369 hours of this total.



Since 1961, (the only previous year for which complete general aviation information is available) the number of total hours has increased by over 62 percent. Non-scheduled commercial air carriers accounted for the largest percent increase in the number of hours flown:- 108 percent from 548,833 hours in 1961 to 1,144,664 hours in 1967. Privately-registered aircraft recorded an increase of over 29 percent from 465,750 hours to 603,311 hours. State-owned aircraft hours increased by 27 percent, from 60,475 to 77,394 hours.

Table 4 summarizes the number of hours flown by civil aviation aircraft in 1967.

Table 4

Civil Aviation Aircraft Hours

By Aircraft Group, By Aircraft Registration

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>Private</u>	<u>Commercial</u>	<u>State</u>
Single Engine				
- Light	559,752	199,382	360,370	-
- Medium	551,392	254,456	295,174	1,762
- Heavy	214,726	24,822	156,020	33,884
Twin Engine				
- Light	159,193	73,554	81,029	4,610
- Medium	58,860	13,395	30,214	15,251
- Heavy	82,354	31,837	42,596	7,921
Multi Engine				
- Transport <sup>(1)</sup>	32,935	462	28,707	3,766
Gyroplane	742	742	-	-
Helicopter	<u>165,415</u>	<u>4,661</u>	<u>150,554</u>	<u>10,200</u>
TOTAL	1,825,369	603,311	1,144,664	77,394

(1) Unit-toll hours for heavy twin and transport group were assumed to be performed under Class 1 and 2 licences and have been excluded from the calculations.

Source: Compiled from 1967 Survey and ATC Files.





The increase in hours flown between 1961 and 1967 was considerably higher than the increase in the number of aircraft engaged in general aviation activity. Thus, it is apparent that the average utilization of each aircraft increased during the same period. The trend towards larger and more productive single engine and twin engine aircraft has probably contributed to the increase in the average aircraft utilization. A further impetus toward greater utilization of aircraft was the increasing use of turbine powered aircraft in general aviation activities. There were only 103 turbine powered aircraft in the civil aviation fleet in 1961. By the end of 1967 this figure had reached 225. Forty-five of these aircraft were privately-registered aircraft compared to only 5 in 1961.

### III Average Annual Utilization

The average annual hours flown per active aircraft rose from 185 in 1961 to 265 in 1967 — a 43 percent increase. The average non-scheduled commercial aircraft flew 551 hours in 1967, a rise of 74 percent over the 1961 figure of 315 hours. The average utilization of privately registered aircraft is quite low. In 1961 the average utilization was 139 hours, by 1967 this figure had dropped to only 113 hours. This low utilization reflects many factors: limited use in the winter; limited use through a lack of suitable landing strips; lack of suitable equipment to operate the aircraft in all-weather conditions etc. State-owned aircraft increased their average utilization slightly; from 343 hours in 1961 to 386 hours in 1967, or 12 percent.

### IV General Aviation Sectors

#### (a) Commercial Aircraft

##### i) Size of Fleet:

In terms of number of aircraft, commercial aircraft ranked second. The 2,725 commercially-registered aircraft represent one third of the general aviation total.

Because of the commercial aspects and associated desire for profitability from the use of these aircraft, air carriers attempt to achieve a high utilization of aircraft. This accounts for the fact that commercial flying operation recorded 59 percent of all general aviation hours in 1967.





ii) Ownership:

The majority of non-scheduled commercial aircraft are owned by private corporations. Table 5 illustrates the type of ownership of commercial air carriers.

Table 5

Types of Business Ownership  
Reported by 272 Commercial Air Carriers

<u>Public Corporation</u>	<u>Private Corporation</u>	<u>Partnership</u>	<u>Private Owner</u>	<u>Unanswered</u>
26	181	12	40	13

Source: 1967 Survey

iii) Non-Schedule Commercial Services:

Commercial air carriers serve the Canadian economy in a variety of ways. Forestry companies use commercial air services to survey forest reserves and to combat forest fires. The construction industry uses the service to ferry men and supplies into remote construction sites. Manufacturers use air service to call on customers, to make deliveries and to receive supplies.

The non-scheduled air carriers offer industry the speed and convenience of the scheduled airline plus the additional flexibility of scheduling individual time tables and reaching numerous airports not served by the airlines.

Table 6 gives an indication of the relative importance of various industry groups in the total number of hours flown for non-scheduled, commercial purposes.



Table 6

Percentage of Total Hours Flown as a Service to Industry Groups

Commercial Air Carriers<sup>(1)</sup>

1967

<u>Industry Group</u> <sup>(2)</sup>	<u>Percent</u>
Agriculture	1.5
Forestry	7.2
Fishing and trapping	3.1
Mines, Quarries and Oil Wells	13.4
Manufacturing	1.7
Construction	4.6
Transport, Communication and Utilities	10.7
Trade	0.7
Finance, Insurance and Real Estate	0.3
Community Business and Personal Services	44.9 <sup>(3)</sup>
Public Administration and Defence	3.0
Other	8.7
Total Hours Flown	100.0 <sup>(4)</sup>

(1) Based on a sample of 68% of the commercial sector.

(2) Standard D.B.S. classification.

(3) Flying training hours included in this category.

(4) May not total 100 percent due to rounding.

Source: 1967 Survey

iv) Commercial Aircraft Avionics:

Commercial air carriers reported the following radio equipment installed in their aircraft during 1967, (Table 7).

Table 7

Radio Equipment Installed

Commercial Air Carriers

1967

<u>Total Companies Reporting</u>	<u>NORDO</u>	<u>VHF Transceiver</u>	<u>OMNI</u>	<u>ADF</u>	<u>HF</u>	<u>Other</u>
272	177	1,190	693	627	611	74

Source: 1967 Survey





v) Unit-Toll Operations:

Public transportation of passengers and goods at a toll per unit are usually not included in a definition of general aviation operations. Most unit-toll operations are associated with Class 1 and 2 air services and to a lesser extent, Class 3. However, Class 3 services are increasing in number owing, perhaps, to charter operators upgrading their licence - to take advantage of the increased base or route protection afforded by this type of licence.

It is also Class 3 licences under which many of the new air taxi operators are being established. Table 8 shows a break-down of 1967 unit-toll hours by aircraft group:

<u>Table 8</u>	
<u>Unit-Toll Hours</u>	
<u>Commercial Aircraft</u>	
<u>1967</u>	
<u>Aircraft Group</u>	<u>Unit-Toll Hours</u> <sup>(1)</sup>
Single Engine	
- Light	124
- Medium	10,913
- Heavy	19,953
Twin Engine	
- Light	9,244
- Medium	9,314
- Heavy	83,691
Multi Engine	
- Transport	318,220
Gyroplane	-
Helicopter	71
TOTAL	451,531

(1) Includes Class 1, 2 and 3 licences.

Source: 1967 Survey





Table 8 clearly shows that the bulk of recorded unit-toll hours are performed by the larger aircraft; usually operated by scheduled airlines. Aircraft in the general aviation category, however, did account for over 10 percent of total unit-toll hours.

vi) Bulk Transportation Operations:

Bulk transportation, more commonly known as charter and contract flying is defined as:

- (1) Public transportation of passengers or goods from a designated base at a toll per mile or per hour for the charter of the entire aircraft (Class 4).
- (2) Transportation of passengers and goods in accordance with one or more specific contracts (Class 5).

Air carriers servicing remote resource developments are very active in the charter field and nearly all their flying is performed in this category. At the other end of the scale, air carriers in the southern metropolitan regions tend to derive most of their revenue from Specialty Air Services, aircraft sales and service, and fuel sales, undertaking charter operations only as a supplement.

The majority of bulk transportation hours are flown by medium and heavy single engine aircraft. The most popular aircraft type for charter operations was the Cessna 180 which recorded 94,392 hours in 1967. The only other types which approached the popularity of the Cessna 180 were the Bell 47 helicopter with 76,106 hours and the De Havilland Beaver with 66,294 hours. A summary of bulk transportation hours is presented in Table 9.



Table 9

Bulk Transportation Hours

Commercial Aircraft

1967

<u>Aircraft Group</u>	<u>Bulk Transportation Hours</u>
Single Engine	
- Light	11,993
- Medium	157,455
- Heavy	118,745
Twin Engine	
- Light	43,381
- Medium	17,420
- Heavy	25,166
Multi Engine	
- Transport	12,594
Gyroplane	-
Helicopter	116,468
TOTAL	503,222

Source: 1967 Survey

vii) Specialty Air Services:

A wide diversity of flying activities such as flying training, aerial photography, and aerial inspection are included in this category. Table 10 shows a breakdown of 1967 total Specialty Air Service hours by aircraft group:





Table 10  
Specialty Air Service Hours  
Commercial Aircraft

<u>Aircraft Group</u>	<u>Revenue Hours</u>
Single Engine	
- Light	346,637
- Medium	121,580
- Heavy	12,190
Twin Engine	
- Light	24,517
- Medium	2,209
- Heavy	8,044
Multi Engine	
- Transport	2,569
Gyroplane	-
Helicopter	33,946
TOTAL	551,688

Source: 1967 Survey

Since "Specialty Air Services" includes such a heterogenous group of activities, the category has been subdivided by the Air Transport Committee of the Canadian Transport Commission into its main components: flying training, recreational flying, aerial photography, aerial photography and survey, aerial application and distribution and so forth.

- (1) Flying training hours accounted for the largest proportion of specialty air service hours:- over 64 percent of total hours. The most popular training aircraft was the light single engine, all-metal Cessna 150, which recorded 156,872 hours or 44 percent of the total flying training hours.



- (2) Recreational flying operations mutually support flying training. As in the case of flying training, the Cessna 150 aircraft was the most popular aircraft used for recreational flying recording 16,303 hours in 1967. The four-place, single engine medium, Cessna 172 ranked a close second with 13,243 hours. The demand for the larger Cessna 172 indicates that a large proportion of pilots using commercial aircraft for recreational purposes desired the convenience of a larger aircraft and were willing to pay the higher aircraft rental charge.
- (3) Aerial photograph (restricted to scenes only) is a relatively unimportant contributor to revenue hours. Most commercial operators who are engaged in this activity also operate other specialty air services. In 1967, the DC-3 recorded 206 hours flown on aerial photography. The Cessna 310 was second with 185 hours. These two aircraft types are also used extensively by Aerial Photography and Survey operators indicating that the two types of aerial photography tend to be undertaken by the same firms.
- (4) Aerial Photography and Survey Operations are largely flown by modern, light twin engine aircraft. The most popular individual types of aircraft used by the industry, however, are the Bell 47 helicopter which recorded 4,111 hours and the large, twin engine DC-3 with 2,469 hours.
- (5) The category "Aerial Application and Distribution" includes aerial seeding; agricultural flying; aerial pest control; aerial spraying and seeding; aerial forest cultivation; aerial reseeding; aerial seeding and fish cultivation.

This type of flying, especially aerial spraying for pest control, have progressed steadily with new techniques for application and more effective chemicals. With the increasing industrialization of agriculture, the demand for special aerial application aircraft is also increasing. New aircraft especially designed for aerial application, such as the Cessna Agwagon, Grumman Ag-Cat and the Piper Pawnee, are replacing older, less efficient war-surplus aircraft. The helicopter has also proven important in aerial application because of its unique "downwash" feature, which makes it more effective in many instances than regular fixed-wing aircraft.





The most popular aircraft for aerial applications in 1967, however, was not a new aircraft model, but an old single engine bi-plane, the Boeing Stearman which recorded 3,012 hours. The Piper Pawnee ranked a close second with 2,850 hours flown.

- (6) Aerial Inspection, Reconnaissance and Advertising includes: aerial patrol and inspection; ice reconnaissance, seal spotting; forest inspection and administration; forest patrol; pipeline patrol; powerline patrol; news service; aerial advertising.

This group of specialty air services is important because of their close relationship to many of the primary resources in the Canadian economy. Forestry, petroleum and hydro-electric concerns employ aircraft extensively for purposes covered under this class of specialty air services.

Helicopters have proven to be the type of aircraft most suited to aerial inspection operations. Their slow flight and vertical take-off and landing characteristics are very important in this regard. The Bell 47 with 4,488 hours and the Hiller 12 with 4,330 hours were the leaders among helicopters. In the fixed-wing category, the Cessna 172 and the Piper Super-Cub with 5,263 hours and 4,942 hours respectively ranked first and second. It is also interesting to note the use of large transport aircraft for work in aerial reconnaissance. Two, four-engine, DC-4's were operated by Kenting Aviation Ltd. under contract to the Department of Transport for ice reconnaissance in the Arctic regions and recorded 2,272 hours in 1967.

- (7) Aerial Control Operations by commercial air services include: forest fire protection; fire fighting; forest fire fighting; hail suppression; aerial frost control; rain making; cloud seeding.

Light "bird dog" aircraft like the Cessna 172 are used to spot fires and direct fire fighters to the fire area. Larger aircraft are then called into the area to help to suppress the fire. The Grumman Avenger, a heavy single engine, World War II fighter aircraft, and the twin engine amphibious Canso are the most popular aircraft for forest fires suppression. In 1967, Avengers flew 2,133 hours in aerial control and Cansos 1,383 hours.



- (8) Aerial Construction includes: aerial hoisting; mountain tram line construction; aerial pole setting; aerial power line construction.

This relatively minor specialty air service is mainly performed by helicopters which have the capability to handle such specialized jobs.

- (9) Air Ambulance and Mercy services are relatively unimportant in their contributions to the total specialty air service hours flown. As a rule, the aircraft are not used by air carriers exclusively for air ambulance services; instead, aircraft are assigned when an emergency condition arises. Most emergency ambulance flights originate in those areas of Canada where surface transport is non-existent or inadequate.

viii) Summary of Specialty Air Service Hours:

Table 11 summarizes the specialty flying hours reported by commercial air carriers in 1967.





Table 11

## Specialty Air Service Hours

## Commercial Aircraft

1967

Specialty Licence	FT	RF	AP	APS	AAD	AIRA	AC	ACTR	AMB	OTHER	TOTAL
Single Engine											
- Light	278,662	28,719	125	266	3,330	8,979	99	-	-	26,443	346,633
- Medium	58,316	19,098	70	1,998	7,205	9,155	5,992	-	16	19,730	121,580
- Heavy	746	299	2	1,110	3,867	3,196	2,665	-	2	303	12,190
Twin Engine											
- Light	9,684	1,309	277	9,357	89	2,050	918	-	44	1,289	24,517
- Medium	-	7	-	2,138	-	51	-	-	-	13	2,209
- Heavy	93	4	206	3,586	-	2,223	1,330	-	6	-	8,044
Multi Engine											
- Transport	-	128	-	48	-	2,272	88	-	-	33	2,569
Gyroplane	-	-	-	-	-	-	-	-	-	-	-
Helicopter	5,924	2,232	165	5,921	1,580	12,537	1,734	745	9	3,090	33,956
TOTAL	353,385	51,796	845	24,424	16,071	40,463	12,335	745	77	50,951	551,688

Source: Aviation Statistics Centre

FT	- Flying Training	AIRA	- Aerial Inspection, and Advertising	Reconnaissance
RF	- Recreational Flying	AC	- Aerial Control	
AP	- Aerial Photography (Scenics)	ACTR	- Aerial Construction	
APS	- Aerial Photography Surveys	AMB	- Air Ambulance	
AAD	- Aerial Application and Distribution			



(b) Private Aircraft

i) Private Aircraft Fleet:

Private flying recorded 603,311 hours in 1967 or 33 percent of total general aviation hours. This is an increase of 29 percent over the 1961 figure of 465,750. Table 12 shows a breakdown of private flying hours by aircraft group in 1967:

Table 12

Total Hours and Average Annual Utilization

Private Aircraft

1967

<u>Aircraft Group</u>	<u>Number of Aircraft</u>	<u>Total Hours</u>	<u>Average Annual Utilization (hours)</u>
Single Engine			
- Light	2,433	199,382	81.9
- Medium	2,263	254,456	112.4
- Heavy	125	24,822	198.6
Twin Engine			
- Light	285	73,554	258.1
- Medium	46	13,395	291.2
- Heavy	66	31,837	482.4
Multi Engine			
- Transport	5	462	-
Gyroplane	46	742	16.1
Helicopter	37	4,661	126.0
TOTAL	5,306	603,311	113.7

Source: 1967 Survey





ii) Average Utilization:

The over-all annual utilization of private aircraft shown in Table 12 is quite low, 113.7 hours. When each aircraft group is examined individually, there are wide differences in utilization. Light and medium single engine aircraft recorded the lowest average hours. This can be attributed to a variety of reasons, such as: lack of pilot qualification and experience; seasonal variations; private operations being usually restricted to daylight hours; and absence of suitable communication and flight equipment.

As the aircraft increase in size, they tend to be owned by business firms. Business firms usually employ professional pilots and have installed in the aircraft sufficient equipment to virtually operate at any time and in any weather conditions. High utilization of a business aircraft is needed to justify its continued use.

iii) Private Flying Activities:

Private flying hours were divided into the following activity groups:

- 1) Business Transportation - operated in the interests of a business;
- 2) Personal Transportation - operated for transportation for non-business purposes;
- 3) Recreational - operated for sightseeing and other pleasure flying;
- 4) Training - operated to up-grade or maintain pilot qualifications.
- 5) Others - operations which are not included in the above categories, such as, testing and ferrying of aircraft.

It proved to be especially difficult to separate business and personal flying since many businessmen use their private plane for company work during the week and for family recreation over the weekend. The survey tried to separate these activities, but some overlap may have occurred.

Table 13 summarizes private flying activities in 1967 by aircraft group:



Table 13

Total Hours Flown by Activities

Private Aircraft

1967

<u>Aircraft Group</u>	<u>Number of Aircraft</u>	<u>Total Hours</u>	<u>Business Hours</u>	<u>Personal Transportation</u>	<u>Recreational Hours</u>	<u>Training Hours</u>	<u>Other Hours</u>
Single Engine							
- Light	2,433	199,382	52,990	32,161	85,360	17,543	11,118
- Medium	2,263	284,456	199,361	42,754	63,647	20,048	8,646
- Heavy	125	24,822	20,841	1,386	1,434	874	287
Twin Engine							
- Light	285	73,554	63,506	4,414	1,669	3,515	450
- Medium	46	13,395	11,533	24	28	667	1,143
- Heavy	66	31,837	28,787	33	-	861	2,156
Multi Engine							
- Transport	5	462	462	-	-	-	-
Gyroplane	46	742	-	-	91	397	254
Helicopter	37	4,661	3,325	285	203	104	744
TOTAL	5,306	603,311	300,805	81,057	152,432	44,219	24,798

Source: 1967 Survey



iv) Private Aircraft Ownership:

The various types of ownership of private aircraft are presented in Table 14; the majority (62%) were owned by individuals.

Table 14  
Ownership by Aircraft Group

<u>Private Aircraft</u>					
<u>1967</u>					
<u>Aircraft Group</u>	<u>Total</u>	<u>Business</u>	<u>Indivi- dual</u>	<u>Joint</u>	<u>Others</u>
Single Engine					
- Light	2,433	220	1,815	350	48
- Medium	2,263	600	1,349	267	47
- Heavy	125	52	55	17	1
Twin Engine					
- Light	285	229	49	6	1
- Medium	46	41	3	1	1
- Heavy	66	63	2	-	1
Multi Engine					
- Transport	5	5	-	-	-
Gyroplane	46	2	43	1	-
Helicopter	37	25	8	3	1
TOTAL	5,306	1,237	3,324	645	100

Source: 1967 Survey

The primary purpose for which the aircraft is used is one factor influencing the type of aircraft purchased. Table 14 indicates a preference for light and medium single engine by private individuals, while more emphasis is placed on twin engine aircraft by business firms.





v) Private Aircraft Powerplant:

The need for high performance aircraft by business firms is demonstrated by the increasing number of turbo prop and pure jet aircraft in the privately registered category. Table 15 shows type of powerplant by aircraft group:

Table 15

Type of Powerplant by Group

Private Aircraft

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>Piston</u>	<u>Turbo</u>	<u>Jet</u>
Single Engine				
- Light	2,433	2,433	-	-
- Medium	2,263	2,263	-	-
- Heavy	125	123	2	-
Twin Engine				
- Light	285	284	1	-
- Medium	46	33	10	3
- Heavy	66	38	9	19
Multi Engine				
- Transport	5	4	-	1
Gyroplane	46	46	-	-
Helicopter	37	37	-	-
TOTAL	5,306	5,261	22	23

Source: 1967 Survey

vi) Geographic Distribution of Private Aircraft:

Geographic distribution of privately registered aircraft shows Ontario having 34 percent of total registration followed by British Columbia with 16 percent and Alberta with 14 percent. Table 16 provides a detailed breakdown by aircraft group.



Table 16

Provincial Distribution

Private Aircraft

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>Nfld.</u>	<u>PEI</u>	<u>NS</u>	<u>NB</u>	<u>Que.</u>	<u>Ont.</u>	<u>Man.</u>	<u>Sask.</u>	<u>Alta.</u>	<u>BC</u>	<u>YT</u>	<u>NWT</u>
Single Engine													
- Light	2,433	12	13	31	40	217	893	243	229	333	387	14	21
- Medium	2,263	14	8	19	33	218	739	200	281	323	402	9	17
- Heavy	125	3	-	1	2	10	41	8	13	24	20	1	2
Twin Engine													
- Light	285	-	5	1	9	29	92	28	8	64	46	1	2
- Medium	46	1	-	-	-	6	22	3	2	11	1	-	-
- Heavy	66	1	-	-	1	17	29	2	-	13	3	-	-
Multi Engine													
- Transport	5	-	-	-	-	-	5	-	-	-	-	-	-
Gyroplane	46	-	-	-	-	24	5	1	3	4	9	-	-
Helicopter	37	-	-	1	-	7	7	2	2	4	12	2	-
TOTAL	5,306	31	26	53	85	528	1,833	487	538	776	880	27	42

Source: 1967 Survey





vii) Average Number of Persons  
Carried in Private Aircraft:

As a general rule, private aircraft accommodate a substantially smaller number of people than commercial aircraft. However, when the average load is multiplied by the number of flights, the total number of passenger trips is in the millions.

The useful data on this subject collected during the survey are shown in Table 17. The arithmetic mean average number of persons per flight in this table is 2.1, but the questionnaire returns were considered to be too unreliable to weigh this average according to the number of flights.

In 1965, the U.S. Federal Aviation Agency conducted a survey to estimate the number of passengers on private aircraft flights, and it was concluded that the average was slightly less than two.

Table 17

Number of Passengers Carried (Including Crews)

<u>Private Aircraft</u>							
<u>1967</u>							
<u>Aircraft Group</u>	<u>Total</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6 &amp; Over</u>
Single Engine							
- Light	1,107	260	733	104	10	-	-
- Medium	1,047	112	576	308	49	2	-
- Heavy	50	5	24	9	8	1	3
Twin Engine							
- Light	165	10	43	62	33	14	3
- Medium	23	-	1	4	6	6	6
- Heavy	42	1	-	1	5	8	27
Multi Engine							
- Transport	-	-	-	-	-	-	-
Gyroplane	10	10	-	-	-	-	-
Helicopter	14	3	7	3	1	-	-
TOTAL	2,458	401	1,384	491	112	31	39

Source: 1967 Survey



Table 17 shows that 56 percent of private aircraft carried on the average only two passengers. Over 97 percent of the private aircraft fleet carried an average of four or less passengers. As can be expected, the only aircraft group which significantly averaged six or more passengers were heavy twin engine aircraft. It is also interesting to note that most of the new light twin engine aircraft, 37 percent, only averaged three passengers per flight.

viii) Private Aircraft Age:

A summary of private aircraft classified by year of construction is shown in Table 18. It can be seen that 46 percent of the private aircraft in Canada are more than 15 years old. This undoubtedly reflects the large number of relatively inexpensive post war aircraft which have not been replaced by newer models. Older wood and fabric covered planes like the Aeronca Chief, Cessna 140, Champion Traveller, Fleet Canuck, Piper J-3 Cub, Stinson Voyager and Taylorcraft are obsolete in one sense, yet high standards of maintenance plus an abundance of spare parts make these airplanes very popular among flying enthusiasts with limited financial means. Many aspiring commercial pilots have also found that ownership of an older aircraft, in many cases, is a less expensive proposition than renting an aircraft from a commercial air service in order to "build up time" for a commercial pilot's licence.

The twin engine category has the most modern equipment. Over half of all light twin engine operating privately in Canada were constructed between 1963 and 1967; in comparison, only 12 percent of the light single aircraft were constructed during the same period.

ix) Year of Purchase:

The survey revealed that there was little relation between the age of an aircraft and the length of ownership. Over 84 percent of the aircraft owners had purchased their aircraft within the last five years; slightly more than 34 percent had purchased the aircraft during the survey year. The only aircraft groups which indicated longer average length of ownership were heavy twins and helicopters. Even most of these two aircraft groups were purchased within the past five years. A summary of the year of purchase of private aircraft is shown in Table 19.



Table 18

Year of Construction

Private Aircraft

1967

1952 &  
Prior

Total

Aircraft Group

1953-57

1958-62

1963

1964

1965

1966

1967

Single Engine

- Light
- Medium
- Heavy

Twin Engine

- Light
- Medium
- Heavy

Multi Engine

- Transport

Gyroplane

Helicopter

TOTAL

1,157  
1,095  
54

798  
319  
33

83  
171  
7

134  
303  
5

20  
45  
1

20  
63  
3

24  
59  
2

35  
74  
3

43  
61  
-

168  
23  
39

14  
5  
16

21  
2  
-

49  
4  
6

6  
-  
1

19  
2  
1

21  
2  
6

18  
4  
7

20  
4  
2

-

-

-

-

-

-

-

-

-

12

-

-

1

-

-

1

6

4

10

2

1

2

3

-

-

2

-

2,558

1,187

285

504

76

108

115

149

134

Source: 1967 Survey





Table 19

Year of Purchase

Private Aircraft

1967 Owners

<u>Aircraft Group</u>	<u>Total</u>	<u>1952 &amp; Prior</u>	<u>1953-57</u>	<u>1958-62</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>
Single Engine									
- Light	1,024	9	20	124	65	87	137	218	364
- Medium	1,004	7	18	121	48	93	148	222	347
- Heavy	47	5	3	6	1	8	2	9	13
Twin Engine									
- Light	164	1	2	15	10	22	26	33	55
- Medium	21	1	3	-	1	1	2	5	8
- Heavy	39	2	3	10	1	-	7	9	7
Multi Engine									
- Transport	-	-	-	-	-	-	-	-	-
Gyroplane	9	-	-	-	-	-	-	-	-
Helicopter	11	2	-	2	-	-	-	3	4
TOTAL	2,319	27	49	279	126	211	322	502	803

Source: 1967 Survey



x) Communication Equipment:

The amount and complexity of communication or "avionics" equipment, installed in private aircraft is increasing each year. A two-way radio is usually the basic communication system; the installation of such equipment increases the utility and safety aspects of private flying considerably. Department of Transport regulations require aircraft to be equipped with two-way voice communication if the aircraft uses the larger DOT airports. Over 78 percent of privately registered aircraft are now equipped with some type of radio equipment. Those aircraft which are not equipped with radio are primarily older, light and medium single engine aircraft based in the more remote parts of Canada or owned by "flying farmers" who restrict their flying to the immediate area and do not operate into controlled air space zones.

Instrument flight rule equipment in private aircraft is also being installed in increasing numbers. The 1961 DOT survey indicated 25 percent of private aircraft were IFR equipped. The 1967 survey shows this percentage has increased to over 35 percent. As one would expect, the survey showed that IFR equipment is generally associated with the newer twin engine aircraft operated by business firms. The results of the survey insofar as IFR equipment is concerned are shown in Table 20.

Table 20

Instrument Flight Rule Equipment

Private Aircraft

<u>Aircraft Group</u>	<u>Total</u>	<u>Aircraft IFR Equipped</u>	
		<u>Yes</u>	<u>No</u>
Single Engine			
- Light	1,238	170	1,068
- Medium	1,137	492	645
- Heavy	60	34	26
Twin Engine			
- Light	181	164	17
- Medium	26	24	2
- Heavy	44	44	-
Multi Engine			
- Transport	-	-	-
Gyroplane	11	-	11
Helicopter	15	2	13
TOTAL	2,712	930	1,782

Source: 1967 Survey





xi) Instrument Flight Hours:

Comments received from a number of respondents indicated that even when the aircraft was equipped for IFR operations, the equipment was infrequently utilized under actual IFR weather conditions. This is believed to be partly the result of limited pilot qualifications (less than 5 percent of the private aircraft owners answering the survey questionnaire held a valid IFR license endorsement), lack of IFR ground facilities at many airports, and the high cost of obtaining instrument flight training.

Table 21 indicates the number of IFR hours performed by private aircraft in 1967.

Table 21

<u>Instrument Flight Hours</u>			
<u>Private Aircraft</u>			
<u>1967</u>			
<u>Aircraft Group</u>	<u>Reported Aircraft</u>	<u>Hours Flown</u>	<u>Average Number of IFR Hours</u>
Single Engine			
- Light	19	630	33.15
- Medium	86	1,839	21.38
- Heavy	6	989	164.83
Twin Engine			
- Light	102	11,527	113.00
- Medium	21	4,537	216.04
- Heavy	39	15,703	402.64
Multi Engine			
- Transport	-	-	-
Gyroplane	-	-	-
Helicopter	-	-	-
TOTAL	273	35,225	129.02

Source: 1967 Survey



xii) Characteristics of Private Aircraft Owners:

1) Reason for Ownership

Owners of private aircraft were asked to indicate the principal reason for aircraft ownership. The majority of owners who responded, some 54 percent, answered that a desire to use aircraft for pleasure trips was the primary reason for owning a private airplane. Within each aircraft group, however, the answers varied. Single engine aircraft owners indicated that pleasure ranked first, while twin engine aircraft owners replied that business requirements or flexibility in scheduling trips was the main reason. Helicopter owners also indicated that business requirements ranked first. A summary of the results obtained from surveyed aircraft owners is contained in Table 22.

2) Owner/Pilot Qualifications

Type of Pilot License

A private pilot license was by far the most common type of license held by the owners of private aircraft. The survey indicated that 86 percent of the owners held this type of license. The private pilot owner dominated each aircraft group. However, as the size of the aircraft group increased, the percentage of aircraft owners with more advanced pilot qualifications also increased. A breakdown of owner/pilot license and aircraft group is shown in Table 23.

Instrument Rating

Only 4 percent of the owners of private aircraft reported they held a valid instrument endorsement. Out of this total, less than 2 percent of the owners who held a private pilot's license also had an IFR rating. Table 24 summarized the number of owner/pilots with an instrument rating by type of pilot's license.



Table 22

Reason for Ownership

Private Aircraft

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>Lack of Commercial Flights</u>	<u>Flexibility of Scheduling</u>	<u>Business Requires Aircraft</u>	<u>Pleasure</u>	<u>Multiple and Other Reasons</u>
Single Engine						
- Light	1,231	14	21	103	859	234
- Medium	1,139	24	77	196	564	278
- Heavy	57	5	3	19	24	6
Twin Engine						
- Light	179	14	40	60	15	50
- Medium	27	1	7	12	-	7
- Heavy	45	1	16	16	1	11
Multi Engine						
- Transport	-	-	-	-	-	-
Gyroplane	11	-	-	-	11	-
Helicopter	15	1	-	10	1	3
TOTAL	2,704	60	164	416	1,475	589

Source: 1967 Survey





Table 23  
Owner/Pilot Qualifications  
Private Aircraft

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>Student</u>	<u>Private</u>	<u>Commercial</u>	<u>Sr. Comm.</u>	<u>A.T.R.</u>
Single Engine						
- Light	951	41	820	74	3	13
- Medium	695	12	610	59	4	10
- Heavy	21	1	14	4	1	1
Twin Engine						
- Light	27	-	18	7	-	2
- Medium	1	-	-	-	-	1
- Heavy	-	-	-	-	-	-
Multi Engine						
- Transport	-	-	-	-	-	-
Gyroplane	10	7	3	-	-	-
Helicopter	6	1	3	2	-	-
TOTAL	1,711	62	1,468	146	8	27

Source: 1967 Survey



Table 24

Owner/Pilot - Instrument Rating

Private Aircraft

1967

<u>Pilot License Held</u>	<u>Total</u>	<u>Instrument Rating</u>	
		<u>Yes</u>	<u>No</u>
Student	50	-	50
Private	1,464	29	1,435
Commercial	143	15	128
Sr. Commercial	8	1	7
Airline Transport Rating (ATR)	27	24	3
TOTAL	1,692	69	1,623

Source: 1967 Survey

Initial Flying Instruction

The majority of private aircraft owners (53 percent) received their initial flying instructions from a DOT approved commercial flying school. Non-profit flying clubs accounted for 38 percent of the total responding aircraft owners initial flight training.

Table 25

Initial Flying Instruction of Owner/Pilot

Private Aircraft

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>Flying Club</u>	<u>Approved School</u>	<u>Military</u>	<u>Other</u>
Single Engine					
- Light	936	364	498	44	30
- Medium	682	257	366	30	29
- Heavy	21	7	12	2	-
Twin Engine					
- Light	26	9	15	2	-
- Medium	1	-	-	1	-
- Heavy	-	-	-	-	-
Multi Engine					
- Transport	-	-	-	-	-
Gyroplane	10	4	3	1	2
Helicopter	6	1	3	-	2
TOTAL	1,682	642	897	80	63

Source: 1967 Survey





### 3) Age of Owner/Pilot

The survey indicated that most owner/pilots of private aircraft were relatively young in age. Thirty-eight percent reported they were between 35 to 44 years of age. The same age group dominated most of the aircraft groups as owners of private aircraft. Table 26 shows the owners age group by aircraft group.

Table 26

#### Age Group of Owner/Pilot

##### Private Aircraft

1967

<u>Aircraft Group</u>	<u>Total</u>	<u>24 &amp; Under</u>	<u>25- 34</u>	<u>35- 44</u>	<u>45- 54</u>	<u>55- 64</u>	<u>65 &amp; Over</u>
Single Engine							
- Light	953	34	237	372	242	63	5
- Medium	694	23	124	270	205	63	9
- Heavy	22	-	6	10	5	1	-
Twin Engine							
- Light	26	1	3	9	8	5	-
- Medium	1	-	-	-	1	-	-
- Heavy	1	-	1	-	-	-	-
Multi Engine							
- Transport	-	-	-	-	-	-	-
Gyroplane	10	-	1	4	5	-	-
Helicopter	6	-	1	3	1	1	-
TOTAL	1,713	58	373	668	467	133	14

Source: 1967 Survey

### 4) Average Annual Income

The average annual income of the owner/pilot of a private aircraft was low in relation to the cost of owning and operating a private airplane. Over 62 percent of the owners reported annual incomes of less than \$10,000. Owners reporting annual incomes of over \$20,000 were less than 10 percent. The results of the survey of owner/pilot annual incomes by aircraft group are shown in Table 27.



Table 27  
Owner/Pilot Annual Income Level

Aircraft Group	Total	Private Aircraft				
		1967				
		4,999 & Under	5,000 9,999	10,000 14,999	15,000 19,999	20,000 & Over
Single Engine						
- Light	941	144	535	170	45	47
- Medium	681	66	277	163	74	101
- Heavy	20	-	11	5	1	3
Twin Engine						
- Light	25	-	4	7	3	11
- Medium	1	-	-	1	-	-
- Heavy	1	-	-	1	-	-
Multi Engine						
- Transport	-	-	-	-	-	-
Gyroplane	10	3	6	1	-	-
Helicopter	6	1	-	2	-	3
TOTAL	1,685	214	833	350	123	165

Source: 1967 Survey



(c) State Aircraft

State aircraft consist of those operated by the Department of Transport and other federal civil departments and by the provincial governments, except for any commercially-registered but state-owned aircraft which operate pursuant to an Air Transport Committee license.

State aircraft flew a total of 77,394 hours in 1967, an increase of over 27 percent over the 1961 total of 60,475 hours.

The activities of state aircraft operations vary from airline-type transport to ice reconnaissance and fire suppression. The operations vary with each government operator and with each type of aircraft. The Department of Transport operates the largest state aircraft fleet, with some 71 aircraft in 1967. The aircraft operated by DOT ranged from single engine Beaver aircraft to four engine Jet stars. The R.C.M.P., Ontario, Québec, Manitoba and British Columbia provincial governments also operate numerous state aircraft for government purposes.

The returns provided by operators of state aircraft were almost a complete report of total activity, and there was, therefore, a very limited element of adjustment to actual returns. Table 28 shows total state aircraft hours flown in 1967 by aircraft group.





Table 28

Total Hours Flown

State Aircraft

1967

<u>Aircraft Group</u>	<u>Total Aircraft</u>	<u>Business Hours</u>	<u>Training Hours</u>	<u>Other Hours</u>	<u>Total Hours</u>
Single Engine					
- Light	2	-	-	-	-
- Medium	4	1,762	-	-	1,762
- Heavy	89	32,600	455	869	33,884
Twin Engine					
- Light	14	3,118	438	1,054	4,610
- Medium	34	8,211	3,026	4,014	15,251
- Heavy	19	5,122	435	2,364	7,921
Multi Engine					
- Transport	6	3,026	696	44	3,766
Gyroplane	-	-	-	-	-
Helicopter	32	8,401	175	1,624	10,200
TOTAL	200	62,200	5,225	9,969	77,394

Source: 1967 Survey



## CHAPTER 4

### Forecast of Future Aviation Activity in Canada

#### I Introduction

A variety of techniques are available to forecast air traffic volumes. This survey of general aviation was designed with the idea in mind that it might be possible to develop analytical models to explain changes in levels of demand. However, a search for the best model to apply requires considerable time and high levels of mathematical expertise. It was felt that a report setting out the main results of the survey should be presented as soon as possible and, rather than wait until the results of comprehensive statistical research had become available, it was decided to present a preliminary forecast based upon a relatively unsophisticated first approach. Later on, if results warrant it, a better forecast of growth in general aviation will be presented.

#### II Forecast Techniques

In order to forecast various general aviation components, regression analysis was used wherever there was a reasonably long historical series of data and trend analysis was applied wherever only sparse statistics could be obtained.

The general aviation components which were forecast were selected on the basis of both usefulness and availability of data. For example, a prediction of general aviation aircraft movements would be quite useful but information of this nature on a national basis is not available. The number of registered general aviation aircraft including private, state, and commercial as well as the hours flown in each of these categories and a further breakdown of commercial hours into bulk, specialty and unit-toll categories were selected as the general aviation components for which forecasts would be prepared.

The economic indicators that were selected for correlation analysis included GNP, population and GNP per capita. The reason for this selection was that these socio-economic factors were felt to be good indicators of the growth pattern of the total level of general aviation activity, and forecasts of these variables have already been prepared by the Economic Council of Canada.



The general aviation components as dependent variables and the socio-economic factors as independent variables were applied to various curves such as first and second degree polynomials, simple and logarithmic parabolas, logistic and gomertz curves, etc. in order to determine which line provided the best fit. GNP per capita was found to be the most highly correlated socio-economic indicator, and therefore the forecasts of general aviation activity were based on the best fitting curve for this indicator. The predicted future levels of the independent variable were then introduced into the equations to derive forecasts of future general aviation activity. Forecasts of the independent variables used as well as the general aviation regression equations are presented in Appendix V.

In the case of the total number of private and state aircraft hours flown, the lack of a historical series of data precluded the use of regression analysis; the forecast was therefore based on an extrapolation of the trend established from 1961 and 1967 data. It was found that private aircraft hours flown had increased at an average rate of about 4.4% between 1961 and 1967, while state aircraft hours flown grew at a slightly lower rate, 4.2%. It was felt that general economic prospects in the future would be comparable to the economic activity achieved in the base period, 1961-1967; in the absence of any good reason to anticipate faster or slower growth, the average rates of 4.4% and 4.2% per annum were used to forecast future activity.

The usual assumptions concerning internal and external economic and political conditions are implicit in both the regression and trend forecasts. Over-all economic conditions are expected to continue on a favourable trend, and it is predicted that the Gross National Product will expand at an average annual rate of between 4.5% and 5.0%. Population growth and increases in average disposable income are expected to broaden the market for general aviation flying while technological developments are expected to be evolutionary rather than revolutionary.

### III Forecasted General Aviation Components

#### (a) Civil Aircraft Fleet

Table 29 shows the total number of registered aircraft in the general aviation fleet as well as the number classified in the private, commercial and state sectors for the years 1961 - 1967; it also includes a





forecast of each component of the general aviation fleet. It is expected that the total fleet will increase by 92% to a level of 17,447 aircraft in 1980 with the growth of the private aircraft fleet increasing the most, 108%, state aircraft the least, 31%; and commercial aircraft in between, 57%.

Table 29  
Civil Aircraft Fleet<sup>(a)</sup>

<u>1961 - 1980</u>				
<u>Year</u>	<u>Total</u> <sup>(c)</sup> <u>Aircraft</u>	<u>Private</u> <u>Aircraft</u>	<u>Commercial</u> <sup>(b)</sup> <u>Aircraft</u>	<u>State</u> <u>Aircraft</u>
1961	5,803	3,635	1,987	181
1962	6,142	3,987	1,972	183
1963	6,420	4,251	1,979	190
1964	6,864	4,652	2,018	194
1965	7,506	5,144	2,162	200
1966	8,265	5,721	2,344	200
1967	9,098	6,277	2,614	207
- Forecast -				
1970	10,492	7,488	2,786	218
1975	13,071	10,015	3,383	242
1980	17,447	13,071	4,105	271

(a) Figures include both active and inactive aircraft.

(b) Includes aircraft providing scheduled services.

(c) Aircraft in Register as of March 31 each year.

Source: 1961 - 1967 data, Civil Aircraft Register

(b) Civil Aviation Hours Flown

Table 30 shows a forecast to 1980 of the number of hours flown for each category of general aviation flying, as well as the past number of hours flown under each classification. It is expected that the total number of hours flown for all categories will increase by 106% over the 13 years, attaining a level of 4,508,572 flying hours in 1980. Commercial hours flown are expected to achieve the greatest growth (121%), while private aircraft hours flown should increase by 75% and state aircraft by 71%.



Commercial hours flown as a percentage of the total hours flown should increase from 69% in 1961 to 74% in 1980, while the private aircraft percentage of the total will decrease from 27.5% to 23% and state from 3.5% to 3.0% during this period.

Table 30

Total Number of Hours Flown

1961/1980

<u>Year</u>	<u>Total Aircraft</u>	<u>Private (a) Aircraft</u>	<u>Commercial (b) Aircraft</u>	<u>State (a) Aircraft</u>
1961	1,351,648	465,750	825,423	60,475
1962			804,846	
1963			832,641	
1964	N/A	N/A	872,332	N/A
1965			1,084,228	
1966			1,311,414	
1967	2,183,505	603,311	1,502,800	77,394
- Forecast -				
1970	2,548,861	686,502	1,774,800	87,559
1975	3,433,275	851,420	2,474,300	107,555
1980	4,508,572	1,055,954	3,320,500	132,118

(a) Forecasts of private and state aircraft hours are subject to wide margins of error due to the absence of historical data.

(b) Includes hours flown by aircraft providing scheduled services.

Source: 1961 - 1967 data, Aviation Statistics Centre, and 1967 Survey.

(c) Commercial Aircraft Hours Flown

Table 31 contains a more detailed breakdown of commercial aircraft hours flown. The table includes the 1961 - 1967 number of hours flown for unit-toll, bulk and specialty purposes as well as a forecast of these categories. In a comparison of the growth of hours flown by category, the largest percentage increase is expected to be attained



by the aircraft flying under the various specialty air service licences. This class should increase by 175% to a level of 1,501,000 hours in 1980, whereas unit-toll and bulk will probably grow by 60% and 116% respectively. Specialty hours should increase their share of the total commercial hours flown rising from 36% in 1967 to 45% in 1980. The unit-toll percentage of the total should decrease from 30% to 22% while bulk should decline by 1% from 34% in 1967.

Unfortunately it was not possible, owing to the lack of historical data, to breakdown the private and state aircraft into a more detailed analysis.

Table 31

Commercial Hours Flown

<u>Year</u>	<u>1961/1980</u>			
	<u>Total Hours</u>	<u>Unit-Toll (a) Hours</u>	<u>Bulk Hours</u>	<u>Specialty Hours</u>
1961	825,523	327,553	313,225	184,643
1962	804,846	312,393	306,324	186,127
1963	832,641	298,655	332,131	201,855
1964	872,332	300,798	337,246	234,288
1965	1,084,228	335,379	431,269	317,580
1966	1,311,414	376,073	481,722	453,619
1967	1,502,800	447,559	509,978	545,263
 - Forecast -				
1970	1,774,800	463,900	619,100	691,800
1975	2,474,300	578,300	837,700	1,058,300
1980	3,320,500	716,700	1,102,100	1,501,700

(a) Includes hours flown by aircraft providing scheduled services.

Source: 1961 - 1967 data, Aviation Statistics Centre





## CONFIDENTIAL

To be used only for planning adequate future facilities for general aviation in Canada. No data on individual aircraft operations will be published.

Department of Transport  
Ottawa  
General Aviation Survey  
1967

Please complete and return this questionnaire in the postage free envelope by \_\_\_\_\_.

as soon as possible

The following registration obtained from the DOT aircraft register indicate you as the owner of the aircraft. Complete as many questions as applicable up to the time you sold or since you recently purchased the aircraft.

CF - - -

## 1. Ownership and Aircraft Information

1. Do you still own the aircraft identified above? If answer is "no", complete only item 1 and 2 below and return form.	Yes _____ No _____	2. Purchaser's: (a) full name _____ (b) mailing address _____ (c) date of _____ disposal _____
3. Aircraft is owned by (check one): business firm _____, one person _____, several (joint owners) _____, other (specify) _____.		4. (a) The year of aircraft's construction: 19____ (b) The date you purchased aircraft: Month _____ Year _____
5. How many aircraft, other than one identified above are owned by you? _____		6. Type of radio equipment installed in aircraft _____: (1) Nordo _____ (2) VHF Transceiver _____ (3) Omni _____ (4) ADF _____ (5) H.F. Transceiver _____ (6) Other (specify) _____
7. Is aircraft equipped to operate IFR? Yes _____ No _____		

## 2. Aircraft Location

1. Aircraft's main base of operation in 1967. _____	2. Distance in road miles from normal residence to main base. _____
--	--

## 3. Aircraft Owner/Pilot Information

1. Do you employ professional pilots to operate the aircraft? Yes _____ No _____	2. If answer to above is "yes", indicate how many pilots were employed during 1967. _____
---	---

The following section is to be answered only by individual owner/pilot.

3. Owner/pilot qualification (indicate type of licence held in 1967 by checking one): Student _____, Private _____, Commercial _____, Senior Commercial _____, ATR _____.	4. Was a valid instrument rating held in 1967? (Either Class I or Class II) Yes _____ No _____
5. Total number of hours logged by owner/pilot since initial flying instruction up to December 31, 1967. _____	6. Initial flying instructions were obtained from (check one): Flying Club _____, Approved School _____, Military _____, Other (specify) _____.
7. Age of owner/pilot (check one): Under 25    25-34    35-44    45-54    55-64    65 and over _____	8. Approximate income level of owner/pilot (check one): Less than \$5,000 _____ \$ 5,000 - 10,000 _____ \$10,000 - 15,000 _____ \$15,000 - 20,000 _____ Over \$20,000 _____  over

#### 4. Reason for ownership of aircraft

1. Indicate the main reason why you purchased this aircraft (check one):

- (a) Lack of commercial flights to desired destinations. \_\_\_\_\_
- (b) Flexibility of scheduling trips. \_\_\_\_\_
- (c) Type of business requires aircraft ownership. \_\_\_\_\_
- (d) Pleasure in owning and flying own aircraft. \_\_\_\_\_
- (e) Other (specify) \_\_\_\_\_

#### 5. Aircraft Utilization

Please indicate flight information of the aircraft above from January 1 to December 31, 1967. If for any reason full year information is not available please indicate time period data which is applicable. \_\_\_\_\_

1. Total number of movements (landings plus take-offs):

Local Movements Cross-Country  
(Flights within the local area) (Flights from points A to B)

\_\_\_\_\_

2. Number of hours flown during 1967 (round to nearest hour):

- (a) Business (operated in the interest of business) \_\_\_\_\_
- (b) Personal Transportation (non-business utility flying) \_\_\_\_\_
- (c) Sightseeing, recreational and other pleasure flying \_\_\_\_\_
- (d) Training and practice \_\_\_\_\_
- (e) Other (specify) \_\_\_\_\_
- Total Hours \_\_\_\_\_

In filling out the following question, the flying time for the categories should include the activity in the following groups:

- (a) Agriculture: Commercial farms - Services incidental to agriculture, excluding Tobacco Processing.
- (b) Forestry: Logging - Forest Services excluding Sawmill operations.
- (c) Fishing: Commercial fishing and Fishery Surveys.
- (d) Mines, Quarries & Oil Wells: Excluding Pipeline patrol and services - Including Prospecting.
- (e) Manufacturing Industries: Include Foods and Beverages. Petroleum and Coal Products - Sawmill Industry - Tobacco Processing.
- (f) Construction: All construction including special trade Contractors.
- (g) Transportation: Do not include flying Training and Recreational Flying - include Pipeline Transportation and patrolling.
- (h) Trade: Include Wholesale and Retail.
- (i) Finance, Insurance & Real Estate: Include all.
- (j) Community Business and Personal Service Industry: Include, Education and Related Services - Health & Welfare not administered by any governmental agency - municipal or otherwise. Services, Legal Accounting Engineering, Tourism Services: fishing etc. Religious organizations.
- (k) Public Administration and Defence: All Government administered Health and Welfare agency, Local Provincial and Federal Government administration Defence.

3. If any hours were flown in "business" above, indicate approximate total hours and the general industry group.

- (1) agriculture \_\_\_\_\_
- (2) forestry \_\_\_\_\_
- (3) fishing and trapping \_\_\_\_\_
- (4) mines, quarries and oil wells \_\_\_\_\_
- (5) manufacturing industries \_\_\_\_\_
- (6) construction industry \_\_\_\_\_
- (7) transportation, communication and other utilities \_\_\_\_\_
- (8) trade \_\_\_\_\_
- (9) finance, insurance and real estate \_\_\_\_\_
- (10) community business and personal services \_\_\_\_\_
- (11) public administration and defense \_\_\_\_\_
- (12) other (specify) \_\_\_\_\_

4. Approximate number of cross-country trips flown in 1967.

Average length of trip (one-way distance from origin to final destination)	Number of trips	
	In Canada	Outside Canada
Under 200 miles	_____	_____
200 - 400 miles	_____	_____
400 - 600 miles	_____	_____
600 - 800 miles	_____	_____
800 - 1000 miles	_____	_____
Over 1000 miles	_____	_____

5. Indicate name of main customs port-of-entry used in 1967.

- (a) Canadian  
1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_
- (b) Foreign  
1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_

6. Average number of persons carried per flight (including crew).

Average number of occupants \_\_\_\_\_

7. Approximate number of hours of IFR flying logged in this aircraft during 1967. (If no hours logged specify none). \_\_\_\_\_

COMMENTS: Please provide any information on the reverse side of the form which will help us understand your answers or will assist us in our study of General Aviation in Canada.

Confidential  
To be used for planning  
adequate future facilities  
for general aviation in  
Canada.

Department of Transport  
Ottawa  
General Aviation Survey  
1967 - (Commercial)

Please complete and return  
this questionnaire in the  
postage free envelope by  
July 13, 1968.

<p>1. Name of aircraft operator _____</p>	<p>2. Is your firm owned and operated as a: (check one)</p> <p>Public corporation? _____</p> <p>Private corporation? _____</p> <p>Partnership? _____</p> <p>Individual ownership? _____</p>																								
<p>3. Type of operating certificate held: IFR _____ VFR _____.</p>	<p>4. Number of aircraft equipped to operate IFR _____.</p>																								
<p>5. Approximate number of hours of IFR flying logged in 1967 _____.</p>	<p>6. Type of radio equipment installed:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Equipment</th> <th style="text-align: left; border-bottom: 1px solid black;">No. of Aircraft</th> </tr> </thead> <tbody> <tr> <td>(1) Nordo</td> <td>_____</td> </tr> <tr> <td>(2) VHF Transceiver</td> <td>_____</td> </tr> <tr> <td>(3) Omni</td> <td>_____</td> </tr> <tr> <td>(4) ADF</td> <td>_____</td> </tr> <tr> <td>(5) H.F. Transceiver</td> <td>_____</td> </tr> <tr> <td>(6) Other (specify) _____</td> <td>_____</td> </tr> </tbody> </table>	Equipment	No. of Aircraft	(1) Nordo	_____	(2) VHF Transceiver	_____	(3) Omni	_____	(4) ADF	_____	(5) H.F. Transceiver	_____	(6) Other (specify) _____	_____										
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(12) other (specify) _____	_____																								

COMMENTS: Please provide any information on the reverse side of the form which will help us understand your answers or will assist us in our study of General Aviation in Canada.







DEPARTMENT OF TRANSPORT  
MINISTÈRE DES TRANSPORTS

YOUR FILE  
VOTRE RÉF:

IN REPLY QUOTE  
RÉF. À RAPPELER:

1316-181 (TPA)

OTTAWA, June 21, 1968.

Dear Sir:

General Aviation Survey  
1967

The Department of Transport is presently conducting a survey of General Aviation in Canada in order to obtain data for the planning of air facilities in the future. The type of information required is presently not collected and is only available from the individual aircraft owner. We are therefore enclosing a questionnaire with the request that you complete and return it before July 13, 1968.

We cannot over-emphasize the importance of your co-operation in making this survey a success. Without this information the Department will be considerably handicapped in its study of General Aviation. It is in your interest therefore that you complete the questionnaire and enable us to properly assess the growth of this important segment of Canadian Aviation.

Do not hesitate to write to the Department if any explanation is needed to fully understand any of the questions. If complete data are not available to answer all questions, we would ask you to provide your best estimates. Detailed information will be considered confidential and no data on individual aircraft operations will be published.

A postage free, self-addressed envelope is provided for your convenience.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'E. L. Hewson'.

E. L. Hewson,  
Director,  
Transportation Policy  
and Research Branch.  
(Hunter Bldg.)

Encl.







DEPARTMENT OF TRANSPORT  
MINISTÈRE DES TRANSPORTS

YOUR FILE  
VOTRE RÉF:

IN REPLY QUOTE  
RÉF. À RAPPELER:  
1316-181 (TPA)

OTTAWA, August 16, 1968.

Dear Sir:

General Aviation Survey  
1967 (follow-up)

On June 21, 1968, the Department of Transport mailed out a questionnaire form to every privately registered aircraft owner in Canada. This survey of General Aviation is required in order to obtain data for the planning of air facilities in the future. The type of information required is only available from the individual aircraft owner.

We have not, as yet, received a completed questionnaire from you as the owner of a privately registered aircraft. We hope this was merely an oversight, or that the completed questionnaire was delayed by the mail strike. Enclosed is another questionnaire form on the chance that the first form was misplaced, with a request that you complete and return it as soon as possible.

We cannot over-emphasize the importance of making this survey a success. Without this information, the Department will be considerably handicapped in its studies of General Aviation. It is in your interest, therefore, that you complete the questionnaire to enable us to properly assess the growth of this important segment of Canadian Aviation.

Do not hesitate to write to the Department if any explanation is required to fully understand any of the questions. If complete data is not available to answer all questions, we would ask you to provide your best estimates. Detailed information will be considered confidential and no data on individual aircraft operations will be published.

A postage-free, self-addressed envelope is provided for your convenience.

Yours sincerely,

E.L. Hewson,  
Director,

Transportation Policy & Research Branch.

Encls.



Appendix V

Forecast of Economic Indicators

<u>Year</u>	<u>Gross National (a) Product in Current Dollars (Millions)</u>	<u>Population (b) (000)</u>	<u>GNP/Capita (\$)</u>
1961	37,420	18,240	2,052
1962	40,580	18,580	2,183
1963	43,420	18,930	2,294
1964	47,390	19,290	2,457
1965	52,200	19,640	2,657
1966	58,120	20,020	2,904
1967	62,070	20,410	3,042

- Forecast -

1968	66,103		
1969	70,730		
1970	75,681	21,294	3,554
1971	80,789		
1972	86,242		
1973	92,063		
1974	98,277		
1975	104,910	23,126	4,536
1976	111,730		
1977	118,992		
1978	126,726		
1979	134,967		
1980	143,743	25,110	5,724

Source:

(a) 1961 - 1967 DBS; 1968 - 1975 based on estimated growth rates in the Fourth Annual Review of the Economic Council of Canada (pp. 89 and 110); 1976 - 1980 based on assumed growth rates of 4.5% in real GNP plus an assumed rate of inflation of 2.0% per annum.

(b) Wolfgang Illing, Population, Family, Household and Labour Force Growth to 1980 (Ottawa: Economic Council of Canada, 1967 (pp. 40 and 41)).



Appendix VI

General Aviation Forecast Equations

1. Total Commercial Hours  
$$\frac{\text{Forecast Variable}}{1,000} = -727.4546 + .7127 \times \frac{\text{GNP}}{\text{Pop.}}$$
2. Unit-Toll Hours  
$$\frac{\text{Forecast Variable}}{1,000} = 49.8647 + .1165 \times \frac{\text{GNP}}{\text{Pop.}}$$
3. Bulk Transportation Hours  
$$\frac{\text{Forecast Variable}}{1,000} = -172.0497 + .2226 \times \frac{\text{GNP}}{\text{Pop.}}$$
4. Specialty Air Service Hours  
$$\frac{\text{Forecast Variable}}{1,000} = -634.5373 + .3732 \times \frac{\text{GNP}}{\text{Pop.}}$$
5. Private Aircraft Registrations  
$$\frac{\text{Forecast Variable}}{1,000} = -1655.2441 + 2.5728 \times \frac{\text{GNP}}{\text{Pop.}}$$
6. Commercial Aircraft Registrations  
$$\frac{\text{Forecast Variable}}{1,000} = 627.2562 + .6075 \times \frac{\text{GNP}}{\text{Pop.}}$$
7. State Aircraft Registrations  
$$\frac{\text{Forecast Variable}}{1,000} = 130.9404 + .0244 \times \frac{\text{GNP}}{\text{Pop.}}$$
8. Total Aircraft Registration  
$$\frac{\text{Forecast Variable}}{1,000} = -895.9045 + 3.2044 \times \frac{\text{GNP}}{\text{Pop.}}$$













